

REMARKS

Reconsideration is requested.

The above amendment of claim 5 is believed to obviate the Section 112, second paragraph, rejection of claims 5 and 6. Withdrawal of the rejection is requested.

The Section 102 rejection of claims 1-9 over Rauchschalbe (U.S. Patent No. 6,369,239) is traversed. Reconsideration and withdrawal of the rejection are requested in view of the following distinguishing comments.

The applicants submit that the decarboxylation of 3,4-dialkoxythiophenedicarboxylic acid and 3,4-alkylenedioxythiophenedicarboxylic acid to the corresponding thiophenes by Rauchschalbe et al(US 6,369.239) was carried out in water immiscible solvents that have a boiling point at least 5°C higher than the decarboxylated product and contains no nitrogen bases.

The following is a description of the problems and disadvantages: See Example 1 in U.S. Patent No. 6,369,239.

The boiling point of the solvent, such as tetramethylene sulfone (=“sulfolane” bp 285 °C, 104 °C/0.2mmHg, water immiscible and mp 27 °C), is close to final product EDOT (=3,4-ethylenedioxythiophene, bp 225 °C), so that the product can not be isolated by fractional distillation under the reduced pressure. Accordingly, the EDOT/sulfolane mixture was distilled from the reaction mixture, subsequently the additional fine distillation was enable to obtain 3% contaminated EDOT. The product of the cited art therefore is contaminated by solvent.

Furthermore, this process is not adequate during the winter time because of the higher mp of solvent. The solvent required additional processing of “melting the solvent”

to pour into the reactor.

The high reaction temperature (140 °C) causes the energy consumption and therefore requires greater manufacturing cost.

By comparison, the presently claimed invention relates to a process for preparation of 3,4-dialkoxythiophenes and 3,4-alkylenedioxythiophenes in high purity by the decarboxylation of 3,4-dialkoxythiophenedicarboxylic acid and 3,4-alkylenedioxythiophenedicarboxylic acid, respectively, in a water-miscible polar solvent in the presence of copper catalyst under an oxygen atmosphere at 120 °C.

The following includes a description of advantages of the presently claimed process.

The use of a water-miscible polar solvent simplifies the workup process by making it easy to remove the solvent from the reaction mixture, which in turn makes simple vacuum distillation possible to isolate the product as, for example, a product of greater purity.

The reaction mixture can be purified by washing with water (to remove solvent and other inorganic components) and by simple vacuum distillation to obtain a final product having a purity of 99.7%. More specifically, washing the reaction mixture twice with roughly the same amount of water removes the solvent and gives the final product with a purity of 95% or more (by Gas Chromatography). Further, simple distillation in vacuum gives the final product having purity of 99.7% or more as a distillate.

In particular, due to the use of a water-miscible polar solvent, the reaction by-products can be readily removed and the solvent facilitates washing the reaction vessel after preparation.

The presence of oxygen in the present invention promotes the decarboxylation step even at a lower temperature (120 °C) in a short reaction time.

In particular, the use of a copper salt and/or a copper powder catalyst in the presence of oxygen promotes the decarboxylation. Thus, the reaction is performed by introducing oxygen-containing air or pure oxygen gas into the reaction.

The claimed invention therefore is submitted to be patentable over the art of record and withdrawal of the Section 103 rejection is requested.

A Notice of Allowance is requested. The Examiner is requested to contact the undersigned in the event anything further is required.

Respectfully submitted,

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